

THE MECHANISM OF PROSTATIC RETENTION.

By E. L. KEYES, JR., M.D.,

CLINICAL PROFESSOR OF SURGERY IN CORNELL UNIVERSITY MEDICAL COLLEGE, NEW YORK.

SEVERAL studies have recently been published on the mechanism of prostatic retention, concluding with the statement that prostatic hypertrophy is not the cause of prostatic retention. Their inference is that prostatic hypertrophy may exist without retention, and that the true cause of retention is to be sought rather in the bladder muscle or innervation than at the bladder neck. They further support this theory with many reported cases of what the French call "prostatism without a prostate." together with Albarrin's theory of muscular weakness.

Two clinical types of prostatic retention may be distinguished: chronic, incomplete or complete retention, and acute complete retention. Though they are related, it is better to discuss their mechanism separately, beginning with the former, the chronic type, since the elucidation of this makes the interpretation of acute retention a matter of but a few words.

CHRONIC PROSTATIC RETENTION. Prostatic retention represents the interaction of two forces, the bladder muscle and the obstruction. The importance of each of these is best understood if they are discussed separately.

THE BLADDER MUSCLE. In discussing the action of the bladder muscle it is convenient to include the nervous mechanism that instigates the act of urination. We have, therefore, to note:

The condition of the muscle itself.

The condition of the nervous system.

The condition of the will.

The Muscle Itself. Suprapubic cystotomy on an old prostatic often reveals a bladder muscle that grossly resembles blotting-paper, and obviously possesses but little contractile force. Quite as often, however, one encounters a muscle with all the macroscopic and microscopic evidence of vitality. After prostatectomy upon these patients we find that the good or bad condition of the bladder muscle has little effect upon the ultimate result. The patient with the "blotting-paper" bladder is almost, if not quite, as likely to regain the power of emptying his bladder as the patient with the normal muscle.

I can recall many instances of complete cure after prostatectomy in spite of a "blotting-paper" bladder; nevertheless, these are a little more liable to incomplete relief by prostatectomy than are their brethren with more normal muscle.

For, supposing for the moment that obstruction at the bladder neck is an element of prostatic retention, it is evident that just

as a strong bladder may fight for a much longer time against an obstruction before it gives away; so, when the obstacle is removed, it must be more completely done away with to give entire relief to a sclerotic bladder than to a normal bladder.

Indeed, an experienced urologist can prophesy with a certain degree of accuracy that the patient with slight infection, and less than 100 c.c. retention, but undue urinary irritation and frequency, is likely to remain in this condition for a considerable time; while the patient who first comes to a physician after his bladder has silently reached chronic, complete retention with overflow will do badly. This prophecy is based in part upon differences in the tone of the bladder muscle. Furthermore, the progressive weakening of the bladder muscle doubtless is the main agency in the rapidity or slowness with which a patient passes through the first and second to the third stage of prostatic retention. Though here, again, the muscle is not the only element in the case.

The Nervous System. When the muscle of the bladder is seriously or completely paralyzed, as in tabes, the resulting retention is probably not solely due to weakness of the bladder muscle, for I have, by means of the Chetwood operation, satisfied myself that a diminution of the sphincteric obstacle at the bladder neck may result in considerable improvement in the symptoms of such patients.

As a striking example of this, let me cite the case of a patient, aged thirty-four years, operated upon in October, 1907, at which time he had been suffering from difficulty in urination for eight years, and for six weeks had been urinating every two hours, with incontinence both by day and by night. He showed a fairly constant residual urine of two ounces, denied syphilis, but had no patellar reflexes; his eyes reacted poorly, his prostate was normal, and he was sexually impotent. He had for a number of years suffered from lightning pains and paresthesia.

His convalescence after Chetwood operation was stormy on account of fulgurating pains, but he healed promptly. The fistula, however, reopened after two weeks, and did not close until December, 1907. Ataxia, which was not present before operation, gradually came on during the ensuing year, and now, six years after the operation, he is markedly ataxic, and speaks of himself as a broken man. Nevertheless, his urinary organs have given him absolutely no further discomfort. He urinates four times by day, not at all by night, and has no pain whatever with micturition.

A second tabetic, who had been ataxic for eight years, and used the catheter for seven: the residual urine varied from 100 c.c. to 500 c.c., and occasionally he had acute complete retention. The Chetwood operation revealed and divided a dense contracture.

His convalescence was also complicated by severe lightning pains. After operation he had complete retention for two weeks, and thereafter he learned that by holding his urine until the bladder contained at least 500 c.c. he could empty it down to 25 or 50 c.c. He continued in this condition until his death from pneumonia about eighteen months later.

This inability to urinate until the bladder is full I have found in a number of tabetics.

A third case, in acute complete retention, was unimproved in spite of two Chetwood operations by me, and several punch operations upon the bladder neck. A similar failure resulted from the cauterization of the neck of a paralysis following operation upon spina bifida.

The diversity of these results is due to the fact that a paralyzed bladder goes into a state of retention when there is even the slightest obstacle to urination at the bladder neck. Indeed, it is the paralyzed bladder that shows that curious combination of incontinence and retention not completely accounted for either by any large residual urine or a contracted bladder. In attempting the removal of this slight urethral obstacle to the emptying of the bladder, one is moved to great conservatism by the fear lest too bold an operation leave the patient more incontinent than before, and one is thus liable to remove only part of the obstruction in these cases where complete removal of the obstruction is most indicated.

The Will. The influence of the will upon retention of urine in typhoid and other wasting diseases was beautifully described by Dr. Samuel Alexander at the first session of the International Urological Congress. He ascribed retention in such cases to actual muscular weakness combined with weakness of the powers of attention. In some old prostatics I seem to have noted a similar unwillingness to take the trouble to empty the bladder. Quite recently an ancient Hebrew came into my service at Bellevue Hospital acutely overdistended, was relieved by suprapubic drainage, followed by prostatectomy under spinal anesthesia. His suprapubic wound healed within three weeks thereafter. Yet, to my great surprise, as soon as the fistula had healed he proved to have retention of urine, averaging about twenty ounces. The lowest amount we ever obtained was six ounces, the highest, forty-eight ounces. Yet his general condition remained excellent for the two or three weeks he remained in the hospital, and his family, who had apparently turned him over to us with high hopes that they might get his savings bank account, rather despaired of my ability to kill him, and so refused permission for any further operation. It is my impression that had the old man been moved by a real desire to empty his bladder he probably could have done so. Doubtless others have seen similar cases,

or at least they have seen that type of case in which after prostatectomy the patient habitually retains from two to four ounces of urine. If you inject into the bladder even a mild solution of potassium permanganate, or silver nitrate, this is emptied out to the last drop.

It seems fair, therefore, to state that the strength of the bladder muscle plays a large part in certain cases of prostatic retention; and that if muscular weakness is the predominant cause of retention, removal of the obstacle at the bladder neck, which is the occasion of the retention, is a more delicate matter than when the bladder muscle has retained its strength.

THE ENLARGED PROSTATE. Let us repeat once more, with Sir Henry Thompson and his followers, that not more than half of the men whose prostates are enlarged suffer from prostatic retention, and let us add that some of those who suffer from prostatic retention have no hypertrophy of the prostate. These are the two facts which, as we said in the first place, impress those who deny that enlargement of the prostate has anything to do with retention of urine. If they will modify their claim and state that the size of the prostate has no bearing upon the amount of residual urine, we agree with them most heartily, but beyond this we cannot go. It is quite obvious that in most instances prostatic retention is due to hypertrophy of the prostate, and it is equally obvious that in most instances the removal by prostatectomy of the hypertrophied portions of the prostate relieves the prostatic retention. But in certain instances this is not the case. There are those who have no prostatic hypertrophy, and to whom, therefore, prostatectomy is not applicable, there are those upon whom prostatectomy has been done without any influence upon their retention of urine, and (let us not forget) there are not a few upon whom a Bottini operation or a shockingly incomplete prostatectomy results in a cure.

These cases require explanation, and lead us to investigate more particularly the changes at the bladder neck associated with the various pathological conditions that excite prostatic retention. Before passing to these, let us state, briefly and categorically, our views as to the role of prostatic hypertrophy in prostatic retention:

1. The mere fact of hypertrophy of the prostate is not of itself sufficient cause for prostatic retention.
2. In order to cause prostatic retention, prostatic hypertrophy must interfere with the outflow of urine from the bladder.
3. This interference may be due to deformity of the bladder neck (of which we shall speak in a moment) or to an actual compression of the urethra within the hypertrophied gland.
4. That this compression, or stricturing, of the urethra cannot usually be an important factor, is evident from several points of

view: In the first place, the urethra is not strictured but rather dilated, as a rule. In the second place, there is usually no obstruction whatever to the passage of a catheter through the prostatic urethra from the time it leaves the membranous urethra to the time it reaches the bladder neck. A canal that transmits an instrument so readily would scarcely offer any resistance to the passage of urine, however weak the bladder.

5. Hence, we are forced to the conclusion that even the lateral compression of greatly enlarged lateral prostatic lobes, probably has little or no effect in interfering with the outflow of urine.

We might note the fact that the occasional success of the Bottini operation in relieving retention due to considerable prostatic hypertrophy is evidence confirmatory of this opinion. We pass, therefore, to consider the nature of the obstacle at the bladder neck.

THE BLADDER NECK. In order to simplify the somewhat complex problem presented by the obstacle of urination at the bladder neck in a case of prostatic retention, let us at the outset exclude from consideration such unusual conditions as hypertrophy of the anterior lobe, or enormous hypertrophy of the middle lobe, or other eccentric growths, since these produce a mechanical obstacle rather different in its nature from that which we usually encounter.

We therefore confine our observations to the usual types of obstruction, which may be classified under the following heads:

1. Middle lobe hypertrophy, more or less pedunculated.
2. Lateral lobe hypertrophy, without a clinically recognizable middle lobe.
3. General hypertrophy, in which neither lateral or middle lobe are prominent.
4. General hypertrophy, in which middle or lateral lobes, or both, are prominent.
5. Contracted bladder neck.

It would obviously be quite impracticable, and happily it seems quite unnecessary, to consider the mechanical obstacle to urination, caused by these different pathological conditions *separatim*. The obstacle is much the same whatever the cause. In order to appreciate its nature let us first compare the observations made by the examining finger when introduced through the perineum into the prostatic urethra of the normal case and the case in prostatic retention. Let us suppose, in the first place, a patient with stricture of the bulbous urethra that has been divided by perineal section. The finger is introduced into this wound, passes through the membranous urethra, usually tearing this somewhat, thence into the prostatic urethra, which is identified as a somewhat dilated portion of the canal that readily admits the finger, and thence into the normal bladder neck, recognizable as an elastic muscular ring, beyond which the tip of the finger may be pushed into the emptiness of the bladder cavity.

Palpation of this muscular ring reveals that it is not prominent upon the roof of the urethra, while it grows more prominent as it approaches the floor. Thus the finger lying in the urethra with its tip against the bladder neck pushes against that part of the ring which even in the normal state rises up to make a slight muscular bar between the floor of the urethra and the floor of the bladder. In prostatic retention this obstruction to the entrance of the finger into the bladder is much more marked. As the finger passes through the prostatic urethra it may encounter and note the presence of prostatic lobes projecting into the canal laterally, or from below, and at the bladder neck, but it also recognizes that the chief obstacle is at the neck of the bladder whether this obstacle be due to prostatic hypertrophy in the form of a middle lobe, or bar, or to sclerosis, in the form of a contracted bladder neck. Indeed, it recognizes that when the bladder neck is tightly contracted, this contraction occurs almost entirely at the expense of the floor, while if only the lateral lobes of the prostate are enlarged the obstacle to the entrance of the finger into the bladder is a veil or bar of bladder neck lifted up between these lateral lobes.

The same observation may be made if these various pathological conditions are examined from a suprapubic opening into the bladder. Whether there be a general "horse-collar" hypertrophy, a contracture, a lateral hypertrophy, or a middle lobe, the finger introduced into the posterior urethra recognizes that between it and the bladder, on the floor of the urethra, there is elevated an abnormal obstruction. This obstruction is the mechanical cause of prostatic retention. It arises from the floor and not from the roof, even in cases of contracture and of lateral prostatic hypertrophy, because the roof of the urethra is more fixed (by the pubo-prostatic ligaments) than is the floor.

The precise way in which this obstacle interferes with the outflow of urine from the bladder has never been absolutely proved. Unquestionably, it prevents the normal opening of the internal sphincter, thus causing the difficulty in starting the urinary stream. But why does it in so many cases reduce the bladder to a condition of partial retention in which the amount of residual urine is practically constant whether the patient stands upon his head or upon his feet? The explanation of the phenomenon is suggested by the fact that if a bubble of air is injected into the normal bladder this always issues after the last drop of urine is passed. In other words, the bubble floating on top of the urine under the vault of the bladder is the last thing to issue from the bladder in a normal urinary act. Moreover, if the bladder contains thick, tenacious pus delivered from a pyonephrosis, and lying upon its base, this pus will issue at the end of the urinary stream, and immediately ahead of the bubble of air which closes the stream.

If there is retention of urine neither the pus at the bottom of the bladder nor the air at its vault are extruded.

To explain these phenomena we must assume that as the bladder empties itself the trigone is somewhat elevated, forming the flare of the funnel, which in a normal bladder begins in the prostatic urethra, and the remainder of the bladder closes down upon this funnel, the lowest and highest points in the bladder cavity lying posterior to the trigone and being emptied last. But when there is retention the funnel is an inadequate one, the bladder neck fails to open as it should, and the result of the effort to squeeze out the last drops of urine is to close the bladder neck. The closure should be interpreted not as a sphincteric gripping, but as the driving of the prominent lower lip of the bladder neck against the upper wall of the prostatic urethra. If the closure were sphincteric a hard push might force it and drive out a few drops more of urine, but inasmuch as it is rather the application in the form of a valve of the prominent lower portion of the sphincter against its upper portion, the harder the patient strains the tighter does the valve close. The only way he can pass any more urine is by relaxing his muscles and permitting the sphincter to open a little. Then another effort may bring forth quite a flow of urine before the valve flaps shut again.

ACUTE COMPLETE RETENTION. Chronic retention is due fundamentally to an inability of the bladder sphincter to open until the bladder is partially full. Acute complete retention is due to a congestion and spasm at the bladder neck of such intensity as to apply the posterior lip of the sphincter against the anterior even when the bladder is full. Operation upon such a case does not reveal an impassible closure of the neck of the bladder, as would be the case were the obstacle a sphincteric or stricture-like one, and not a valve-like one.

The mechanism of acute complete retention, is, of course, the same in prostatic abscess as in prostatic hypertrophy.

One readily understands without further comment how various combinations of obstruction, congestion and spasm produce the many variations in the clinical phenomena of prostatic retention, while the gradual progress of the increase in the amount of retention of the urine as the months go by is due largely to gradual decrease in the strength of the bladder muscle.

PRACTICAL DEDUCTIONS. Several practical conclusions may be drawn from the above remarks. In the first place, since mere prostatic hypertrophy is not enough to cause prostatic retention, prostatic retention may sometimes be relieved by removal of the obstacle at the bladder neck without any attention to the prostate, even when this is hypertrophied. This the Bottini operation used to do blindly, and, as it were, accidentally, while the Chetwood

operation achieves it intentionally. I have several times relieved the retention, great or small, of a patient whose prostate showed bilateral enlargement, simply by dividing with the Chetwood instrument the bar at the neck of the bladder, while paying no attention to the enlarged lateral lobes. The same thing can sometimes be done when the median lobe of the prostate is hypertrophied, when it is in the form of a bar or a pedunculated lobe, though it is obviously safer under these circumstances to remove the bar or lobe. But the point illustrated by the success of the Chetwood operation is that an attack directed solely upon the bladder neck at its lowermost part can relieve prostatic retention. Yet when the prostate is considerably enlarged it were obviously futile to satisfy one's self with division or excision of the bar or middle lobe, for then the lateral masses at the bladder neck crowd in and still interfere materially with the opening of this orifice. Indeed, whatever the condition of the bladder muscle at the time of operation we can count upon this growing weaker as the years elapse. Hence our ambition should be to remove all possible obstacles to urination, including all hypertrophied portions of the gland.

But it cannot be too often repeated, the prostatectomy, the removal of the hypertrophied portions of the prostate gland must be looked upon only as a means to an end, that end being the removal of the obstacle at the bladder neck. Hence the technical disadvantage of perineal prostatectomy, especially for the neophyte who is likely to be satisfied with removal of the more immediately presenting portions of the hypertrophied prostate, while totally disregarding the obstructing bladder neck that lies beyond. Hence, also, the mechanical superiority of suprapubic prostatectomy, since the attack from above inevitably at least tears open the neck of the bladder, while this is the last region reached from below.

It has been our experience that no operation for prostatic hypertrophy will give 100 per cent. of cures among the survivors, for the peculiarities of healing after operation and the weakness of the bladder muscle may well frustrate our most intelligent efforts. Yet, in conclusion, we should like to insist in theory as we always have in practice that the problem of prostatic retention is a mechanical problem; that the bladder neck, and especially the elevation of its inferior lip, is the important mechanical obstruction, and that prostatectomy, suprapubic or perineal, total, sub-total, or partial, should be performed with the object of obliterating this obstacle at the bladder neck.